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Published in:
Social Science & Medicine

DOI:
10.1016/j.socscimed.2016.06.007

Publication date:
2016

Accepted Manuscript

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PII: S0277-9536(16)30288-X

DOI: 10.1016/j.socscimed.2016.06.007

Reference: SSM 10680

To appear in: *Social Science & Medicine*

Received Date: 30 January 2016

Revised Date: 24 May 2016

Accepted Date: 7 June 2016

Please cite this article as: Meijering, L., Weitkamp, G., Numbers and narratives: Developing a mixed-methods approach to understand mobility in later life, *Social Science & Medicine* (2016), doi: 10.1016/j.socscimed.2016.06.007.

Manuscript #: SSM-D-16-00304

Manuscript Title: “Numbers and narratives: developing a mixed-methods approach to understand mobility in later life”

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Numbers and narratives: developing a mixed-methods approach to understand mobility in later life

Abstract

The aim of this methods-focused article is to explore the potential benefits of integrating GPS, diary and in-depth interview data to gain richer insights into the everyday mobility practices of older adults. Eighteen adults, aged 65 to 90 years, living in the Netherlands, participated in the study. Our findings illustrate how quantitative (GPS) and qualitative (interviews and diary-based) approaches together can generate different insights and layers of understanding from each individual method in order to enhance the overall study findings.

Our findings demonstrate that our methodological approach generates new insights with respect to GPS-measured and self-reported mobility, time-geographies, and micro-geographies of older adults in the Netherlands. In conclusion, our mixed-methods approach contributes to a better understanding of the everyday mobility practices of older adults, and could be used in other demographic groups.

Keywords: Netherlands; mixed methods; GPS tracking; in-depth interviews; travel diaries; mobility; time-geography

1. Introduction

Being mobile enables older adults to participate in meaningful activities, which in turn enhances their well-being (Nordbakke & Schwanen, 2014; Schwanen et al, 2012; Webber et al, 2010). The theoretical foundation for many studies on mobility is formed by Hägerstrand's time-geography (1970). This offers a useful framework for studying revealed activity and travel patterns, shaped by various constraints in space and time. In its earlier years the theory was developed at the

micro-level, while its applications were zone-based (e.g. life space measures). This changed in the 1990s, when micro-level activity and travel data became available, as well as GIS techniques to manage and analyze these type of datasets. From then onwards, research has focused on the refinement of spatio-temporal, geocomputational techniques to describe measured or potential spatial movement of individuals (Buliung & Kanaroglou, 2006).

Time-geography has been criticized for its positivist characteristics, which come to the fore in its focus on objectively-measured revealed mobility without going further to explore people's perceptions and lived experiences of their everyday mobility patterns (Ellegård & Svedin, 2012). Much research on mobility is characterized by a focus on tracking mobility: measuring out-of-home mobility in terms of distances covered, speed of movement, and number of places visited (Almanza et al, 2012; Chan et al, 2014; Neven et al, 2013; Shoval et al, 2011). There is some, mainly qualitative, work on self-reported mobility, which focuses on people's perceptions of and satisfaction with their mobility (see Goins et al, 2015). However, much research either focuses on GPS-measured or (qualitative) self-reported mobility, and does not compare, combine or integrate the two methods. A notable exception is the work by Kwan & Ding (2008), which combined narrative analysis, qualitative GIS, 3D GIS-based time-geography methods, and computer-assisted qualitative analysis. More recently, work in which GPS tracking has been combined with methods such as qualitative GIS, in-depth interviews, walking interviews, travel diaries and participant-led photography, has emerged (Bell et al, 2015; Jones et al, 2011; Lord et al, 2009; Milton et al, 2015; Zeitler et al, 2012; Zeitler & Buys, 2015). These studies demonstrate that multiple research methods can enable a better understanding of the complex and various questions around the everyday geographies of mobility (Christensen et al, 2011).

The added value of the present study lies in the combination of GPS, travel diaries and in-depth interviews, applied to the theme of mobility and wellbeing with respect to older adults in the Netherlands. The aim of the present study was to explore the potential of integrating GPS, diary

and in-depth interview data to gain insight into the everyday mobility practices of older adults in the Netherlands.

2. Methodology

Mixed-methods approach

Since our focus in terms of content was on older adults' everyday mobility practices in relation to their well-being, we adopted a convergent mixed-methods design (Creswell, 2009; Fetters et al, 2013). We used GPS-tracking, travel diaries and in-depth interviews for the purposes of triangulation and complementarity (Fielding & Fielding, 2008). The added value of this mixed-methods approach lies in how complementary and contrasting results from the different methods can be used to generate new insights, how different methods can be used to generate different layers of understanding, and how the results of one method can be used to inform the other method(s) (Tariq & Woodman, 2013).

There is an emerging literature in which GPS-based analytic approaches are used for different purposes capturing different aspects of mobility. In studies that focus on physical activity, GPS tracking is typically combined with accelerometer data. Such studies relate physical activity of, for instance older adults or adolescents, to the walkability of neighborhoods, park visits, and modes of travel such as commuting or school-travel, and public transport (Carlson et al, 2016; Chaix et al, 2014; King et al, 2011; Marquet & Miralles-Guasch, 2015; Stewart et al, 2016; Voss et al, 2014; 2016; Winters et al, 2015). Other studies use GPS tracking to measure activity space (Hirsch et al, 2014; 2016; Lee et al, 2016). Our study can be distinguished from those cited above insofar as we combined quantitative and qualitative methods, instead of using only quantitative methods. In so doing, we seek to combine GPS-measured mobility with self-reported mobility (see, for example, Kelly et al, 2013; Panter et al, 2014). The self-reported mobility in our study is based on indept-interviews, and to a lesser extent on the diaries.

We first collected GPS data and travel diaries. Subsequently, in-depth interviews were conducted. We aspired to integrate the different methods through 'building' (Fetters et al, 2013). This means that for each participant, the results from the GPS data and diaries, in terms of places visited, purposes of travel, modes of transportation, and travel companions, informed the focus of the in-depth interview. The data collection was carried out by a research group led by the authors as senior researchers, and included nine third-year undergraduate students. The students collected the data, and the data-analysis was performed by the authors. GW took the lead in the analysis of the GPS data and travel diaries, and LM in the thematic analysis of the in-depth interviews. In the process, we continuously compared and integrated the emerging results from the different methods, through which we achieved a comprehensive analysis of the data.

Sampling

The research was conducted in the Netherlands among older adults, defined as 65 years and over. Data were collected in November and December 2014. The researchers recruited older adults through purposive sampling, using their own social networks and snowball-sampling. Purposive sampling is commonly used in qualitative and mixed-method research (Teddlie & Yu, 2007). Participants were asked in person, by email or phone to participate. Some people declined to participate, because of the time and effort required. We recruited eighteen participants, twelve women and six men, aged 65 to 90 years, all native Dutch. The different methods were connected through the sampling frame: each of the participants in our sample participated in all three research methods (Fetters et al, 2013: 2139). Half of the participants were part of the social network of one of the students. but participants were never interviewed by someone they knew personally.

GPS tracking

In our approach to GPS data collection and processing, we drew on Kerr et al (2011). The participants were asked to carry a GPS tracker for eight consecutive days, whenever leaving their home. The aim of the GPS tracking was to record the participants' space-time patterns. We used the QStarz Travel Recorder BT-Q1000XT, which has relatively high accuracy, good signal acquisition time, battery life, and data storage, and is also easy to use (Schipperijn et al, 2014). Participants needed to press a power button to turn it off and on, and to make sure to charge it every night. The students delivered the GPS tracker in person to each participant, explained its use and asked participants to charge it every night. They also gave the participants an information sheet with instructions for use, to consult later if necessary. The first tracking day functioned as a trial-day, which was not included in the analysis. When problems with the use of the device were identified, they could be resolved during that day. For fifteen participants, at least seven consecutive days were recorded. For three participants, multiple days were not recorded, as they had forgotten to bring the tracker, turn it on, or recharge the battery.

The generated data consisted of the latitude, longitude, date and time, which were recorded every ten seconds. We used the GIS software V-Analytics to create a dataset with visited places and movements between those places (trajectories), the steps of which are shown in Figure 1.

<Insert Figure 1 about here>

The white circles represent the registered GPS points (Figure 1A). Each consecutive point was connected with a line, and a bounding box with a diagonal of 80 meters (red boxes) was used to distinguish activities and trajectories (Figure 1B). When GPS points were continuous in a bounding box for more than five minutes, an activity was created. The activities were used to split trajectories, and one or more activities at the same locations were clustered to create places (Figure 1C). Various measures were calculated for each place and trajectory (Figure 1D).

We found V-analytics more useful to analyze space-time movement data, compared to standard GIS software packages (see, for example, Andrienko et al. 2013).

Travel diaries

During the eight days of GPS tracking, the participants were asked to keep a written travel diary, in which they recorded all out-of-home activities they engaged in. The aim of the diaries was to collect self-recorded mobility for comparison with GPS-measured mobility, and to collect additional data on each trip. Participants wrote down the time they had been away from home, the purpose of the activity, with whom they had been, and the modes of transportation they had used. Fourteen of the eighteen participants kept a diary. Reasons for not filling out the diaries were either that participants had difficulties remembering the activities they had engaged in, or that it took too much of their time.

We digitalized the diaries, coded the recorded information on mode of transportation, travel companion(s), and type of activity, and merged it with the GPS data (see Fetters et al, 2013). The diary data were compared with the GPS data, and we found that for six out of our eighteen participants, either GPS- or diary-data were missing. The observed differences between GPS and diaries stem from the fact that both capture different elements: a GPS tracker measures all outdoor movement, provided it is carried and can detect a signal, whereas participants are likely to write down in a travel diary only what is memorable for them. It might be, for instance, that the GPS plot would show a participant walk to a post-box round the corner from home, which was then not recorded in the travel diary as it is just routine and not necessarily deemed significant by the participant.

This reflects some of the potentially pre-reflective, habitual aspects of mobility in which participants routinely choose to engage, as well as their conceptualizations of place and activity.

In-depth interviews

One to three weeks after they had worn the GPS device, each participant was interviewed. During the interviews, the participants' mobility practices were discussed in relation to their self-reported well-being. The complete interview guide can be found in Appendix 1. Since we had one standardized interview guide, some interviewers may have conformed to this more than others. The interviews were conducted in the homes of the participants, audio-recorded and transcribed verbatim. Each interview lasted around sixty minutes. The data from the interviews were analyzed with Atlas.ti, according to the principles of thematic analysis (Joffe & Yardley, 2003).

Ethical implications

Our institution's ethical committee advised positively about the study. The data have been anonymized as much as possible. Pseudonyms have been used to represent participants for the purpose of this article. Although the GPS data could not be anonymized, the home locations in the maps as presented in the results are masked. The participants were informed about the purpose of the project, as well as each of the used methods. Time was taken to explain the GPS tracking in particular, to make sure all participants understood the privacy implications of carrying the GPS device. All participants consented verbally to participate in the project, and to the use of their data for study and research purposes. Participants could withdraw from the study at any point.

3. Findings and discussion

Overall, the self-reported wellbeing and mobility was rated relatively high. During the in-depth interviews, the participants rated their wellbeing and mobility on a scale from 1-10. They rated their wellbeing as 7.5 on average (SD = 1.4). Their main sources of wellbeing varied, and

consisted, for instance, of social contacts, listening to music, and doing sports. They rated their mobility as 8.0 on average (SD = 1.2). Thirteen participants had a car, twelve of whom had a driver's licence. Six of the participants used one or more mobility aids: four used a walker, one used a walker and a cane, and one used a wheelchair and a mobility scooter. Based on the diaries, the number of visited places varied substantially among the participants (M = 12.0, SD = 5.5). The average traveled distance in kilometers, measured with GPS, also varied substaintially (M =65.9, SD = 45.7)

Mobility geographies

In reporting our findings, we have integrated the different methods through weaving them together in the narratives, and through joint displays (Fetters et al, 2013). When we compared the GPS-measured and self-reported mobility of our participants as recorded during the week, differences emerged. We discuss Corry's case as an example, the storyline of which represents most of our other participants. Corry is an 81-year old widow, who lives on her own in a small town with a population of around 3,500. The interview revealed that she suffers some physical ailments; she had hip surgery and osteoporosis, but does not use any mobility aids. The diary revealed her means of transport: she walks and uses a bicycle, electric bicycle and car. Figure 2 shows Corry's mobility based on the mixed methods.

The GPS-measured mobility is represented by the places she visited and the routes she travelled. Town A is her home-town, where she visited family and friends, and went to the supermarket (ten places in total). In town B she went to the doctor, shops, and the town hall (five places in total). In town C she visited family (one place in total).

<Insert Figure 2 about here>

Corry's self-reported mobility was examined through the interview-data and is represented in the quote. During the interview, she stressed how she did not experience any restrictions with regard to her mobility. However, she contextualized this by telling us how she had adapted her mobility needs to her own experience, age and impairments. Her adapted expectations are reflected in her GPS-measured out-of-home mobility. Corry's example shows us that looking at only GPS tracks or interview-data, could overlook nuances in participants' everyday mobilities: Figure 2 demonstrates how different methods can generate different layers of understanding through apparently contradictory findings. Therefore, quantitative models to study mobility, such as the life space model (Lewin, 1951; Webber et al, 2010), should at the very least be carefully interpreted. However, activity space models that integrate qualitative and quantitative data can include characteristics that capture the relationship between individuals and their environment (Mennis, 2013). Thus, a mixed-methods approach such as ours has the potential to refine current findings in which GPS tracking is used to define the activity spaces of older adults (Hirsch et al, 2014; 2016).

Time-geographies

When looking at the times during which our participants were active, the GPS results show many of our participants only engaged in out-of-home activities during the day, especially from late morning until dusk. Joan's time-diagram in Figure 3 illustrates this, although the timeframe within which she engaged in activities was smaller than that of most other participants. Joan was an 82-year-old widow who lived in a large town and did not use any mobility aids.

<Insert Figure 3 about here>

Joan brought up another issue when we discussed her use of time in the interview:

> [My daughter] comes and has lunch with me on Thursdays, but well it's 45 minutes and she's gone again. So I ask her to come over more often, but she works every day, so it has to be in the evenings; they're always playing golf on Saturdays and Sundays, that's up to them. They forget about me. […] I don't drive and then they tell me to go out, but I can't. (Joan)

Joan feltthat the people in her social network, especially her children, were not available to engage in social contact as often as she would like, and not at the times of the day and week that she herself would prefer. In line with Bell et al (2014), our findings demonstrate the value of a mixed-method approach to better understand the role of relational agency with regard to wellbeing. Furthermore, our findings illuminate the significance of the differing time-geographies of people in different phases of their life course – in particular for the social lives of older adults, as has also been found by Lager et al (2015).

Micro-geographies

This mixed methods approach enhanced our appreciation of the micro-geographies of mobility practices. We use Angela's case as an example here. Angela is an 81-year-old widow who lives in a suburb. During her interview, she told us how she would walk to a nearby supermarket on a daily basis. She explained how she took different routes, depending on the weather circumstances on a particular day:

> I: Do you have problems with reaching the shops over here, or not?
>
> A: No. […] Well, um, there's this large apartment building over there.
>
> I: Yes.

A: And when it's windy, there's always a lot of wind down there.

I: Yes.

A: Always, always [laughter]. Yes, it really is like that, it's always windy down there, and it's extra fierce. […] Yes, I always have to walk past it. But I can also, then I take the other corner and the street back there [...] so I take that street over there, and that's not so windy (Angela).

Angela felt she could not cope with the winds that gust along a large apartment building close to her home. Through her coping strategy of taking a different route, she managed to leave her home and take her daily walk, irrespective of the wind. Angela's brief efforts to point out her routes to the interviewer were not sufficiently detailed to be sure of the exact routes taken, and her travel diary did not explain why these diversions were made. However, the GPS data provided precise clarification of the weather-related diversions she raised within the interview (Figure 4).

<Insert Figure 4 about here>

This example demonstrates how mixed methods can be used to generate different layers of understanding, engaging with the complexities of older adults' everyday mobilities by securing insights from different perspectives. The combination of traditional qualitative methods and big data sets such as GPS data can be used to enrich or complement the analysis performed in mobility research (Kwan & Schwanen, 2016). The ability to collect time–space data at such high resolution in time and space creates opportunities to formulate new research questions that could not be asked previously; for example the impact of external dynamic variables on mobility behavior, such as weather conditions (Shoval et al, 2010).

4. Conclusions

This study shows that a mixed-method approach including GPS tracking, diaries, and in-depth interviews can open up new insights into the everyday mobilities of older adults. First, we found evidence that GPS-measured mobility can differ from self-reported mobility. Second, the emphasis on time-geographies revealed how the agency of our participants was sometimes limited when their time-geographies differed from those of their social contacts. Third, our mixed-methods approach enabled us to gain insight into the micro-geographies of mobility.

There are, however, some limitations to our study. The data collected with the GPS tracker and the travel diary covered one week of mobility patterns. Although most of the participants confirmed that the activities were representative for other weeks, we do not have a quantitative method to determine the representativeness of the data. Furthermore, it is not possible to study habitual movement patterns, or to identify and explain exceptions. With regard to representativeness, seasonality is also relevant: the data were collected in November and December, late autumn and early winter in the Netherlands, characterized by relatively low (sometimes below zero) temperatures, rain, and darkness. Our participants' mobility would probably have varied, had the study been conducted in spring or summer. This confirms the findings of Portegijs et al (2014), who found some seasonal effects in the mobility of older adults.

A further limitation is that the risk for missing data is relatively high with the approach we used, probably because of the diversity of tasks that participants were asked to perform. For one-third of our sample, either GPS- or diary-data were incomplete. Furthermore, the participants were not asked to expand on each specific trip or place as recorded with either GPS or diary during the in-depth interviews. Thus, more use could be made of detailed information on each place and trajectory, such as mode of transportation, speed, and travel companions, as was done by,

for instance, Bell et al (2015) and Milton et al (2015). Such an approach would open up possibilities to deepen knowledge on the everyday geographies of mobility.

Future studies could build on our approach, since it demonstrates the added value of integrating measured and self-reported accounts of mobility, including both quantitative and qualitative methods. There is still room to optimize this approach by studying other methods of data collection and analysis, such as go-along interviews, mental maps, accelerometers and biophysical mobile sensors. In this context, it is important to acknowledge that the optimal mix of methods depends on the research question at hand.

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Acknowledgements
We are indebted to the students who collected the data in this research project: Aukelien Antonides, Eva Bakker, Elisa van Bergen, Maaike Hofstra, Stefan Jurrjens, Joost Mazier, Berber Oosterhagen, Eppie Silvius, and Gijs Textor. Furthermore, we want to express our gratitude to the study participants. We thank three anonymous peer reviewers for their constructive feedback. Finally, thanks to the editors of this special issue, for putting it together.

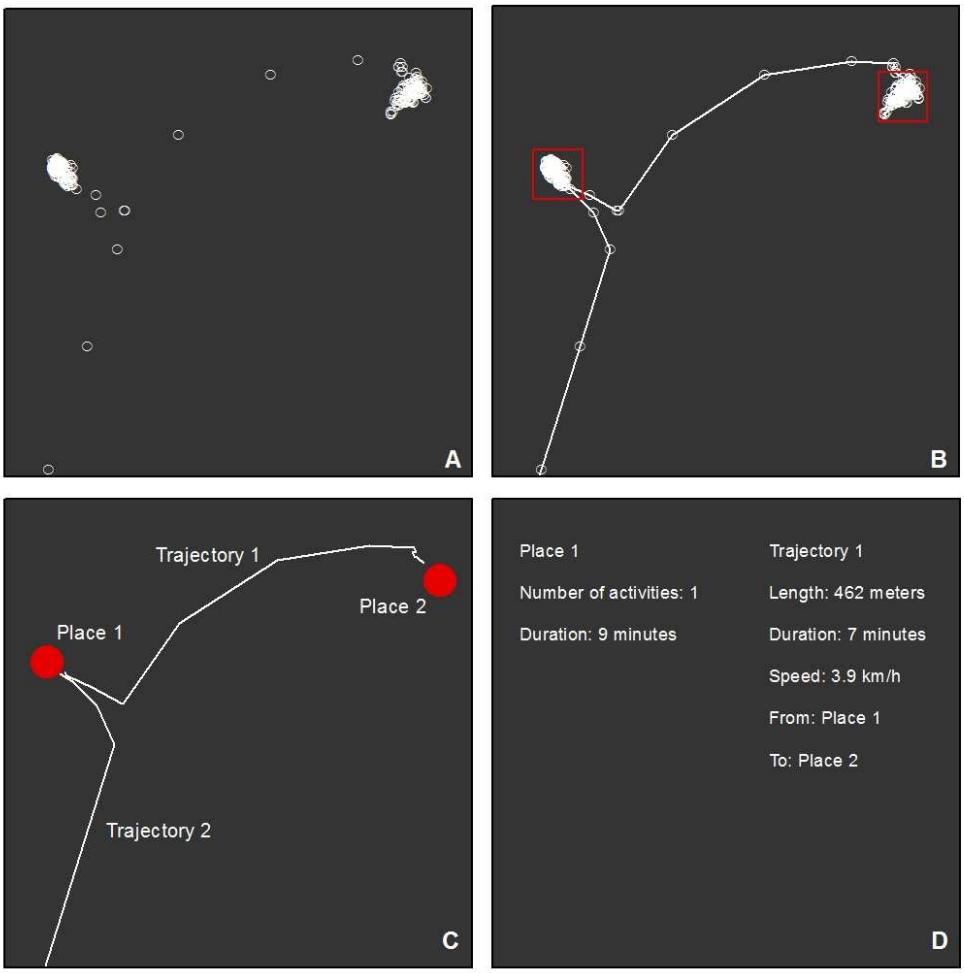
Figure captions

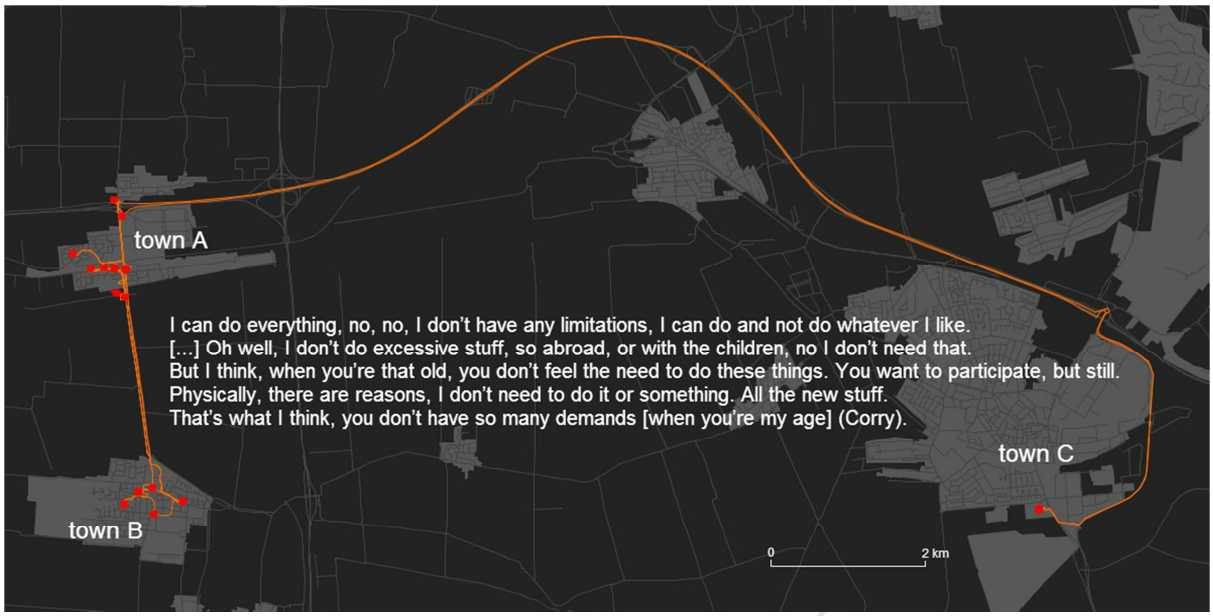
Figure 1: From GPS points to places and trajectories

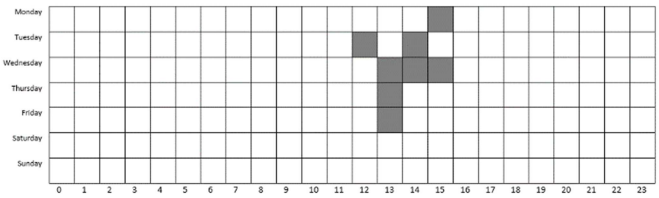
Figure 2: Corry's one-week mobility pattern

Figure 3: Joan's time diagram showing the time at which she started an activity. On the x-axis the hours of the day, and on the y-axis the days of the week

Figure 4: Mobility pattern of Angela showing two different routes on two different days (yellow and orange), to and from the supermarket


A
B
Trajectory 1
Place 2
Place 1
Trajectory 2
C
Place 1
Number of activities: 1
Duration: 9 minutes
Trajectory 1
Length: 462 meters
Duration: 7 minutes
Speed: 3.9 km/h
From: Place 1
To: Place 2
D






supermarket
home
0
150 Meters

Highlights

- Our mixed-methods approach increases understanding of mobility of older adults
- The approach combined GPS-tracking, travel diaries and in-depth interviews
- GPS-data and self-reported data generate new insights in mobility geographies
- Our mixed-methods approach enables multi-layered understanding of time-geographies
- Our mixed-methods approach enables multi-layered understanding of micro-geographies